



# Einstein Ring

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## Why in News?

The [European Space Agency's \(ESA\) Euclid space telescope](#) discovered a rare **Einstein ring** around the galaxy **NGC 6505**, nearly **590 million light-years** away from Earth.

**Note:** A light-year is the distance light travels in one year, which is 9.46 trillion kilometres.

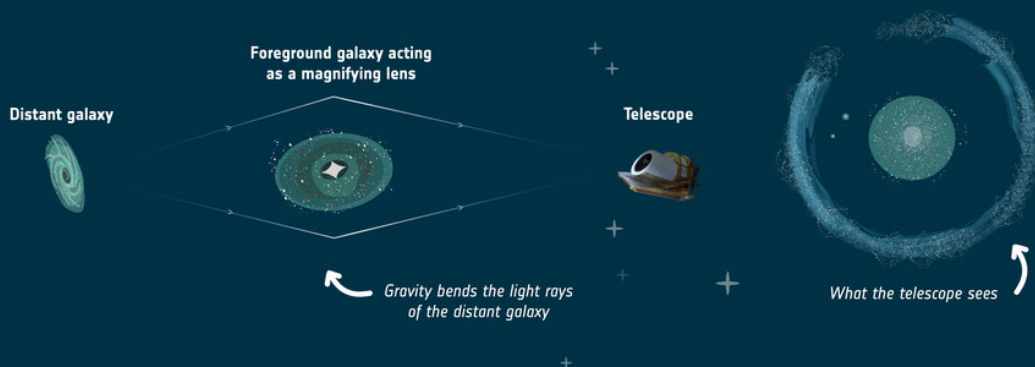
## What is an Einstein Ring?

- **About:** An **Einstein ring** is a **ring of light** that appears around a celestial object, such as a [dark matter](#), galaxy or cluster of galaxies.
  - A full Einstein ring appears only if the observer (Euclid telescope), lensing object, and background galaxy are nearly perfectly aligned.
- **Gravitational Lensing:** It is a phenomenon caused by [gravitational lensing](#), where a massive celestial body (like a galaxy) creates a **gravitational field** that **bends and amplifies the light** from a more distant object behind it forming a complete ring around the foreground object, known as an **Einstein ring**.
  - The object causing the light bending is called a gravitational lens.
- **Discovery:** First discovered in 1987, Einstein rings are extremely rare, found in less than 1% of galaxies.
  - The Einstein ring around NGC 6505 is formed by light from an unnamed galaxy 4.42 billion light-years away, distorted by the **gravitational pull of NGC 6505**, creating the striking **ring-like appearance** observed around it.
- **Nomenclature:** **Albert Einstein's General Theory of Relativity** predicted that light **could bend and brighten** (warp space-time and curve the path of light) around massive objects due to their gravitational pull, hence the name "**Einstein ring**."
- **Observation:** Not visible to the naked eye, can only be observed through **powerful space telescopes** like **Euclid**.
- **Scientific Importance:** They provide a unique way to study the Universe because they act as a **natural magnifying glass**, revealing details of distant galaxies that would otherwise be invisible.
  - Einstein Rings are valuable tools in **astrophysics** because they help scientists investigate **dark matter** and study [dark energy](#) (**responsible for the accelerating expansion of the Universe**).

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## EINSTEIN RING – EXPLAINED

When we observe a distant galaxy with our telescope, its light may encounter another galaxy on its way to us. The foreground galaxy acts like a magnifying lens, bending the travelling light rays due to its gravity. This is called gravitational lensing. If the background galaxy, the lensing galaxy, and the telescope are perfectly aligned, the image appears as a ring – called an Einstein ring.



## Phenomena Similar to Einstein rings

- **Einstein Cross:** An Einstein Cross is a rare **gravitational lensing** phenomenon where light from a distant galaxy is bent by a massive foreground galaxy, creating four distinct images around it in a cross-like pattern.



orange blob of light surrounded by four blue dots That is the Einstein cross.

## UPSC Civil Services Examination Previous Year Question (PYQ)

### Prelims

Q. In the context of modern scientific research, consider the following statements about

**'IceCube', a particle detector located at South Pole, which was recently in the news: (2015)**

1. It is the world's largest neutrino detector, encompassing a cubic kilometre of ice.
2. It is a powerful telescope to search for dark matter.
3. It is buried deep in the ice.

**Which of the statements given above is/are correct?**

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

**Ans: (d)**

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